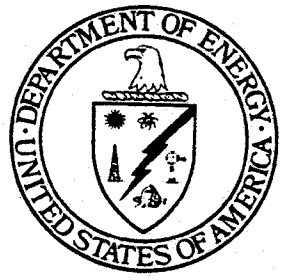
GEN-ZR-0015

Scholar

EXECUTIVE SUMMARY OF THE DOE SSFL SITE RADIOLOGICAL SURVEY

SANTA SUSANA FIELD LABORATORY

VENTURA COUNTY, CALIFORNIA



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Prepared for

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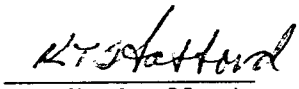

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ABSTRACT

A comprehensive radiological inspection was performed at 25 locations within Rockwell International's Santa Susana Field Laboratories (SSFL) Area IV. The purpose of this survey was to determine if radioactive contamination exists to such an extent that further inspection or decontamination is warranted. These locations, as identified by the "Radiological Survey Plan for SSFL" (Reference 1), included facilities and areas where radioactive materials were used (or possibly used) to support AEC, ERDA, and DOE programs. Because these locations are not included in a government-funded maintenance and surveillance or decontamination and decommissioning program, the objective of this survey was to identify areas requiring decontamination before release for unrestricted use.

This work was performed for the San Francisco Operations Office of DOE by Rocketdyne Division of Rockwell International. The radiological survey began in August of 1987; reporting was completed in October 1988. Some specific locations were identified as having residual radioactivity at levels requiring decontamination; however, no current hazard exists to present occupants, the environment, or neighboring communities. This executive summary is a brief overview of the guidelines, conditions, and sampling techniques used in the performance of this survey, and a presentation of the major radiological findings.

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SCOPE

Located in Ventura County, California, SSFL Area IV has been used to support government-sponsored programs for developing and testing nuclear powered reactors, fabricating nuclear reactor fuels, and disassembling irradiated nuclear fuel elements. The major AEC-funded programs which affected Area IV were the Sodium Reactor Experiment (SRE), Organic Moderated Reactor (OMR), Sodium Graphite Reactor (SGR), Hallam Nuclear Power Facility (HNPF), Piqua Nuclear Power Facility (PNPF), Systems for Nuclear Auxiliary Power (SNAP), and the Uranium Carbide Pilot Fuel Facility (UCPFF). These programs have ended, and the facilities that supported these programs have been modified and reassigned for other non-nuclear DOE programs. Some of these facilities are known to be contaminated and are planned for decommissioning or decontamination by the Surplus Facilities Management Program (SFMP). Other facilities were, until performance of this survey, suspected to contain residual radioactivity because of the operations performed there or in adjoining facilities. These suspect locations were identified by old photographs, historical records, project histories, and veteran employees. Within the DOE-optioned area and in adjacent areas, 25 suspect locations were identified and reported to DOE in 1985 (Reference 1). That report specified the locations to be surveyed, what contaminants were suspected, any known problems, and how the survey was to be performed. Some of the suspect facilities were used for zero-power reactor experiments, nuclear-related testing, or fuel fabrication. Some were simply support laboratories for non-nuclear related work. Still others were storage yards, salvage and scrap areas, access pathways, and surrounding areas of nuclear-related facilities.

The likelihood of residual radioactivity differed from location to location depending on facility use, and varied from slightly suspect to not suspect. It was expected that radioactive contamination in these facilities would not have resulted in significant spread outside the areas identified for the survey. Although some minor radiological contamination incidents probably occurred, it was common practice to decontaminate and return an

affected location to its natural condition. Twenty-five locations were inspected for radioactive contaminants. Twelve reports were written and released to document the results of this comprehensive survey. For purposes of report preparation, locations of similar characteristics or project histories were grouped into the same report. The Radiological Survey Map on page 8 shows the areas included as part of this radiological survey and the report numbers corresponding to each survey location. The green colored locations show the areas surveyed; red shows where contamination was found at such a level that further inspection and/or decontamination are necessary. Table 1 below is a list of those survey locations with a brief description of why residual radioactivity was suspect or possible, and major results.

Table 1. Radiological Survey Locations

Facility or Area Surveyed	Reason for Survey	Result
Building T005	Uranium carbide fuel fabrication facility from late 1950s 1969.	Both filter plenums and all 3 R/A exhaust ducts are contaminated.
		R/A liquid drain lines contaminated.
Sodium Disposal Facility Building T886	Non-radioactive sodium-contaminated components disposed of until mid 1970s. Determine if any contamination spread from open-field pits to surrounding area.	Open-field pits contaminated.
Building T064	Used for storing depleted and enriched uranium, U-233, and plutonium. Some repackaging was performed.	SRE Moderator Cask internally contaminated.
		Outdoor Eastern area has soil contamination.

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Facility or Area Surveyed	Reason for Survey	Result
Building T029	Radiation instrument calibration laboratory. A Ra-226 source incident is known to have occurred in a confined source well 10 ft deep.	Ra-226 storage well is contaminated.
Buildings T030 and T641	T030 housed a Van de Graaff accelerator. T641 is a site shipping and receiving facility; R/A laundry and sources were shipped from T641.	No contamination found.
Old ESG Salvage Yard	Old Equipment Yard for Area IV projects.	No contamination found.
Rocketdyne Barrel Storage Yard	Equipment Yard for Rocketdyne, Area IV projects.	Slight soil contamination.
New Salvage Yard (T583)	New Equipment Yard for Area IV projects.	No contamination found.
T513 Parking Lot and Old R/A Laundry Area	Access path near SRE and R/A Laundry Facility.	No contamination found.
SRE Storage and Trash Dump (Plot 333)	Dumpsite for SRE materials.	No contamination found.
SRE-to-RMDF Field	Dumpsite for SRE materials.	No contamination found.
KEWB-to-RMDF Field	Site of old reactor facility (KEWB).	No contamination found.
Buildings T019, T013 and an Area to the Northwest	T019 was used for SNAP critical testing. Other facilities were for SNAP non-nuclear support.	No contamination found.
T626 Storage Area	Equipment storage.	No contamination found.
T056 Landfill	Operated as a landfill through the mid 1970s. Known chemical contamination.	No surface contamination found. Subsurface condition is unknown.

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Facility or Area Surveyed	Reason for Survey	Result
23rd Street-to-T100 Field	Storage yard. Old photo shows a trench used for burning trash.	No contamination found.
Field across from Building T011	Dirt dumpsite.	No contamination found.
Building T373 (and T374)	SNAP critical facility.	No contamination found.
Building T375	SNAP non-nuclear test facility.	No contamination found.
Building T049	Within fence-line of Building T005.	No contamination found.
Building T042	SNAP non-nuclear test and support facility.	No contamination found.
Building T027	SNAP non-nuclear test and support facility.	No contamination found.
Building T032	SNAP non-nuclear test and support facility.	No contamination found.
Building T025	SNAP non-nuclear test and support facility.	No contamination found.
Building T009	Critical test facility for OMR and SGR.	SGR R/A liquid holdup tank internally contaminated.

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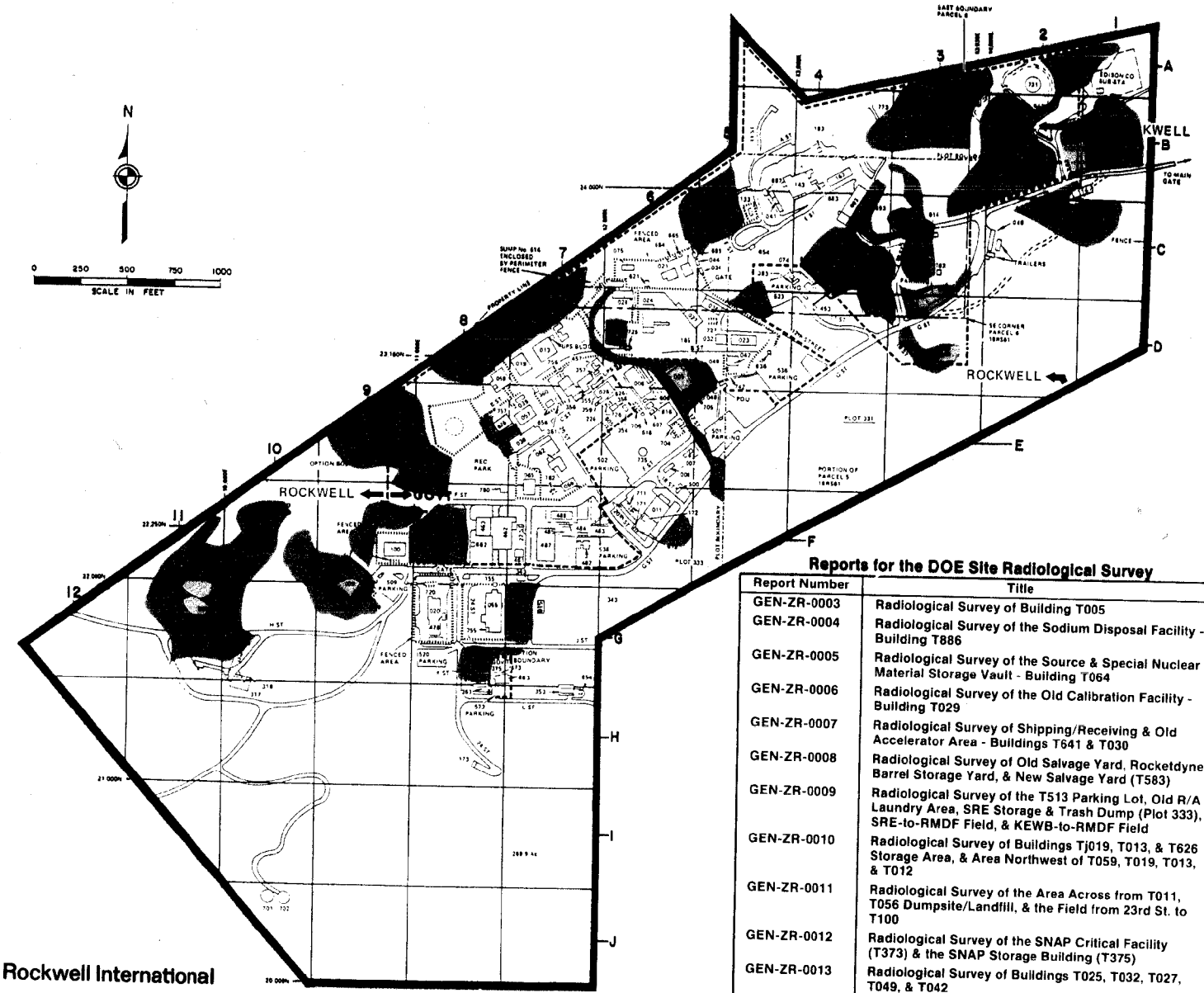
Radiological Survey
Santa Susana Field Laboratory



Reports for the DOE Site Radiological Survey

Report Number	Title
GEN-ZR-0003	Radiological Survey of Building T005
GEN-ZR-0004	Radiological Survey of the Sodium Disposal Facility - Building T886
GEN-ZR-0005	Radiological Survey of the Source & Special Nuclear Material Storage Vault - Building T064
GEN-ZR-0006	Radiological Survey of the Old Calibration Facility - Building T029
GEN-ZR-0007	Radiological Survey of Shipping/Receiving & Old Accelerator Area - Buildings T641 & T030
GEN-ZR-0008	Radiological Survey of Old Salvage Yard, Rocketdyne Barrel Storage Yard, & New Salvage Yard (T583)
GEN-ZR-0009	Radiological Survey of the T513 Parking Lot, Old R/A Laundry Area, SRE Storage & Trash Dump (Plot 333), SRE-to-RMDF Field, & KEWB-to-RMDF Field
GEN-ZR-0010	Radiological Survey of Buildings Tj019, T013, & T626 Storage Area, & Area Northwest of T059, T019, T013, & T012
GEN-ZR-0011	Radiological Survey of the Area Across from T011, T056 Dumpsite/Landfill, & the Field from 23rd St. to T100
GEN-ZR-0012	Radiological Survey of the SNAP Critical Facility (T373) & the SNAP Storage Building (T375)
GEN-ZR-0013	Radiological Survey of Buildings T025, T032, T027, T049, & T042
GEN-ZR-0014	Radiological Survey of Building T009

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METHODS

For each facility or open-area listed in Table 1, a sampling plan was formulated based on the likelihood for residual radioactivity, and on potential contaminating radionuclides. The flow chart in Figure 2 shows the inspection method. Guidelines and conditions for performance of this survey are specified in the references, and are also based on Rocketdyne experience for releasing several Rockwell-owned facilities for unrestricted use. Total-average and removable alpha/beta activity were measured in facilities where residual uranium or plutonium contamination was possible. Ambient gamma exposure rates were measured at all facilities. Soil, water, and miscellaneous samples were collected and analyzed for radioactivity as specified by the survey plan (Reference 1), or when other measurements showed possible radioactivity.

Because of the extensive area associated with this radiological inspection, it would have been unacceptably time consuming and not cost effective to measure all radiologic characteristics over 100% of the area. Compromises and adjustments were made to the survey by establishing priorities and accepted tolerances and detection limits for assessing residual radioactivity in a sampling lot. Inspection by variables was used to judge whether a sampling lot met an acceptable quality level, e.g. whether the contamination level is less than established acceptable contamination limits for release for unrestricted use. By applying sampling inspection by variables methods, the accuracy of the conclusion made about the level of contamination was not sacrificed because of a decrease in number of sampling locations.

In areas where alpha/beta measurements were acquired, 1 m^2 was surveyed per 9-m^2 area. This sampling frequency corresponds to an 11% sampling plan, which has been adopted to be consistent with NRC and State of California guidance for releasing a facility for unrestricted use. This sampling plan is based upon a uniform 3-m square grid superimposed on a uniform inspection area. For gamma exposure rate measurements, data was

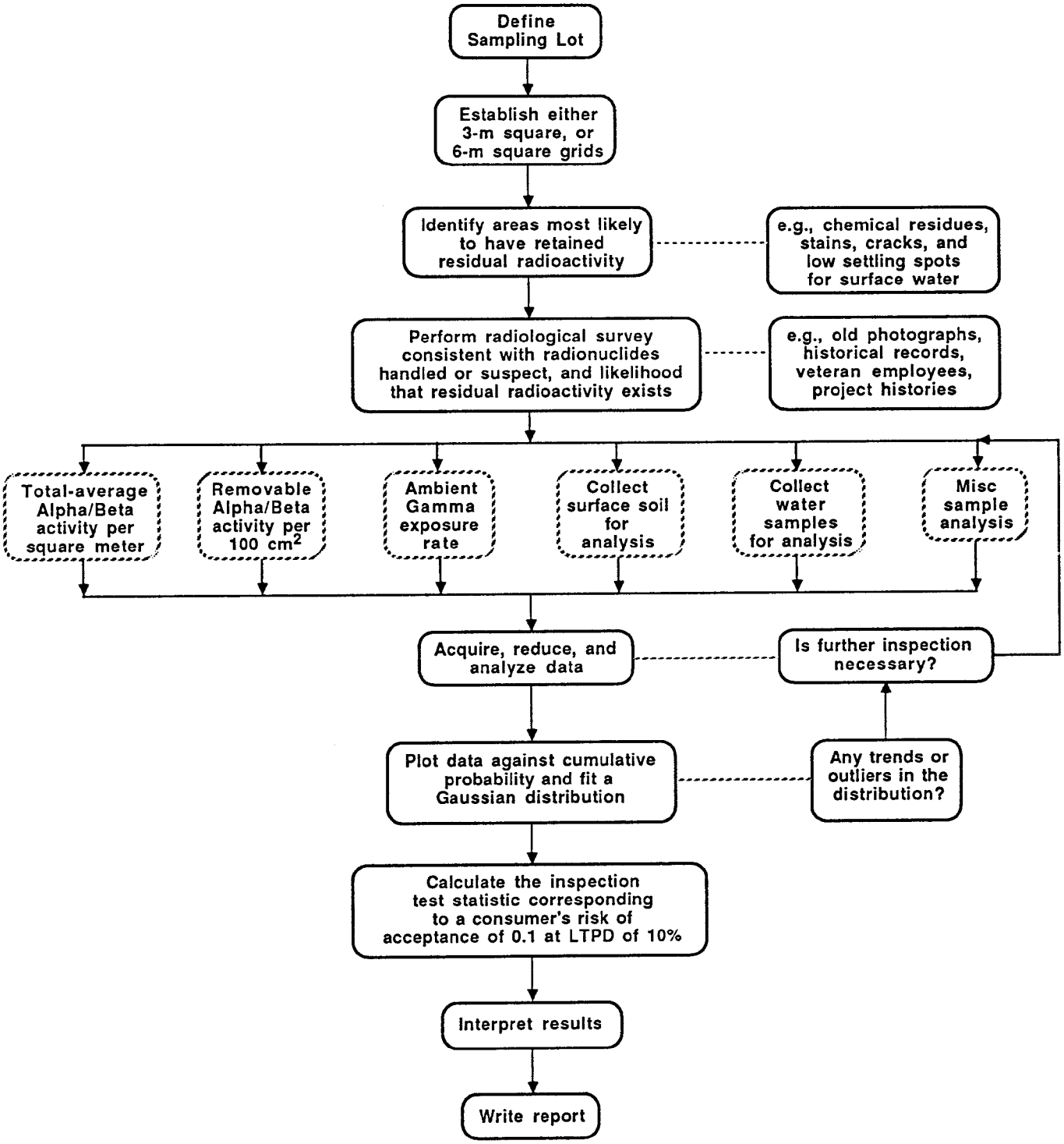
Define Sampling Lot
Establish either 3-m square, or 6-m square grids
Identify areas most likely to have retained residual radioactivity
e.g., chemical residues, stains, cracks, and low settling spots for surface water
Perform radiological survey consistent with radionuclides handled or suspect, and likelihood that residual radioactivity exists
e.g., old photographs, historical records, veteran employees, project histories
Total-average Alpha/Beta activity per square meter
Removable Alpha/Beta activity per 100 cm2
Ambient Gamma exposure rate
Collect surface soil for analysis
Collect water samples for analysis
Misc sample analysis
Acquire, reduce, and analyze data
Is further inspection necessary?
Plot data against cumulative probability and fit a Gaussian distribution
Any trends or outliers in the distribution?
Calculate the inspection test statistic corresponding to a consumer's risk of acceptance of 0.1 at LTPD of 10%
Interpret results
Write report

Figure 2. Site Survey Sampling Chart

acquired on a 6-m square grid (a 2.7% survey) because instrument sensitivity is much greater. This sampling plan, coupled with the analytical inspection techniques used throughout the site survey, gives acceptable tolerance limits and measurement sensitivity for concluding that the area is not contaminated, slightly contaminated, contaminated above acceptance limits, or whether further inspection is necessary.

To measure total-average alpha/beta radioactivity and gamma exposure rate, Ludlum model 2220-ESG portable scaler instruments were coupled to a Ludlum model 43-1 alpha scintillator, Ludlum model 44-9 Geiger-Mueller pancake probe, and Ludlum model 44-10 NaI gamma scintillator, respectively. Measurements of alpha/beta radioactivity per square meter were made in 5 min. to comply with ANSI draft standard N13.12 (Reference 2) relative to alpha-probe transit velocities. Gamma exposure rate measurements were acquired for 1 min., 1 meter above the ground or facility floor. Instrument response, background, and efficiency were checked (with appropriate radiation standards) 3 times a day for the project duration.

Measurements of removable alpha/beta surface activity were made by wiping approximately 100 cm^2 of area with a cloth disk (NPO sampling smears 2 in. diameter). Radioactivity on the disk was measured using a thin-window Canberra gas-flow proportional counter. This instrument was also calibrated 3 times a day.

Surface soil samples (no greater than 3 in. deep and 2 lbs in weight) were collected in each 36-m^2 area at the Sodium Disposal Facility (report number GEN-ZR-0004) and in several drainage trenches in Area IV. These samples were analyzed for gross alpha/beta radioactivity and by gamma spectrometry. The same Canberra gas-flow proportional counter used for smears was used for each 2-g soil sample. Adjustments were made to the calibration factors for gross alpha/beta measurements in soil to account for natural background soil radioactivity and alpha self-absorption. Gamma spectrometry was done by use of a 450-ml soil sample in a Marinelli beaker with a high purity germanium detector coupled to a Canberra Series 80 Multi-

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Channel Analyzer. Samples were counted for 30 min. Gamma spectrometry allows isotopic identification and quantification.

Water samples and miscellaneous samples such as sludge from drain-line clean outs and hold-up tanks, Masslinn wipes from filter banks, and miscellaneous debris were also analyzed by gamma spectrometry "for indication" of contaminants.

Suspect items and locations including wall coving, cracks, crevices, residues, low spots, ventilation returns, sinks, mops, fume hoods, entrances, I-beams, light fixtures, storage racks, and miscellaneous equipment were surveyed "for indication" of radioactivity. Alpha and beta probes were connected to Ludlum model 12 countrate meters to survey these items. Smears were collected and analyzed for removable radioactivity.

All radiation measurements were compared against DOE residual radioactivity limits specified in "Guidelines for Residual Radioactivity at FUSRAP and SFMP Sites," (Reference 3), Regulatory Guide 1.86 (Reference 4), ANSI Standard N13.12 (Reference 2), US NRC License SNM-21 (Reference 5), and the Federal Register (Reference 6). If a difference in acceptance limits was observed between these references, then the most conservative (smallest) value was adopted. Acceptance limits for unrestricted-use used for testing these inspection areas are presented in Table 2.

Table 2. Acceptable Residual Radioactivity Limits for This Survey

Radionuclides	Allowable Total Residual Surface Contamination (dpm/100 cm^2) Average	Maximum	Removable
Transuranics, Ra-226	100	300	20
Th-Natural, Th-232, Sr-90	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90	5,000	15,000	1,000
Ambient Gamma Exposure Rate	5 μR/h Above Background at 1 m from the Surface		
Soil Activity Concentration, including natural background			
· Ra-226, Th-232, Th-230	21 αpCi/g		
· Enriched Uranium	46 αpCi/g		
· Beta-gamma Emitters	100 βpCi/g		
Water Activity Concentration	5×10^{-6} μCi/ml (α)	3×10^{-7} μCi/ml (β)	

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RESULTS

A few locations were identified which require further investigation and decontamination before they meet criteria for release for unrestricted use. The following results summarize applicable survey limitations (as might affect the survey results), and major findings of this survey, and provide recommended actions for remediating contaminated areas. No facility or area is a radiological hazard or health risk to employees, the environment, or neighboring communities.

Building T005

Specific locations of Building T005 were identified as being contaminated above acceptance criteria. Partial decontamination of this facility since performance of the radiological survey in 1987 has reduced the number of contaminated locations. Both radioactive material ventilation exhaust filter plenums and all exhaust ducts leading to them are significantly contaminated with enriched uranium. A stand-alone exhaust duct about 60 ft long on the north side of the facility is also contaminated. These ducts are not easily accessible and are confined in such a manner that release of radioactivity is unlikely. The filter plenums are posted as radioactive material areas, and are kept locked. Removal of these exhaust ducts and filter plenums as radioactive waste will be required to complete decontamination of the facility. The only radioactive liquid drain lines remaining are located outside T005, about 15 ft from the northeast corner, to an area (about 40 ft) where the old R/A liquid holdup tank used to be. All other known radioactive liquid drain lines have been removed. All interior rooms meet acceptance criteria for unrestricted use. A detailed survey (including alpha, beta, gamma, and soil sample analysis) of drain trenches, sludge, and open culverts leading from T005 showed that no radioactivity spread to surrounding areas.

Sodium Disposal Facility, T886

The Sodium Disposal Facility, T886, was inspected for residual radioactivity in an area surrounding the two open-field pits. Sodium disposal activities took place in the open-field pits and in the concrete facility. The open-field pits are known to be contaminated with Cs-137 and Sr-90. The scope of this survey was established to determine if any surface migration or deposition of radioactive contaminants from the open-field pits had occurred. Results of an extensive surface soil sampling and analysis effort show that no radioactivity above naturally occurring levels is present on the surface in a 3-acre area surrounding the open-field pits. Particular attention was paid to collect samples from surface water runoff pathways. Subsurface sampling was not performed because subsurface migration of any contaminants is very slow and was not considered to be significant in this case. Buried radioactive debris may exist in locations, but none was discovered by gamma exposure rate measurements. The survey report presents historical data which shows that the two open-field pits are contaminated. The pits are posted and the area is fenced near the access road, even though no radiological hazard exists at those low levels. Further inspection and decontamination is required in the two open-field pits.

Source and Special Nuclear Material Storage Vault, T064

Building T064, known as the Source and Special Nuclear Material Storage Vault, has two known locations which are contaminated at levels above acceptance limits. The SRE Moderator Cask, which is parked on the southwest side of the facility grounds, is internally contaminated. The cask exterior showed no radioactivity. The second contaminated location which will require further investigation and remediation resulted from a leaking cask which contained mixed fission products. This cask was stored in the eastern storage yard within the fenceline. Contaminants followed the drainage course easterly about 75 ft beyond the fenceline in a natural terrain area. The extent of this contaminated area may cover up to 4000 sq

ft; the depth is not known. The most significantly contaminated area was 300 sq ft at a location about 75 ft east of the fence. Ambient gamma exposure rates in this area measured 100 μR/h at 1 m and 300 μR/h at contact--about 8 times normal background. Cs-137 concentrations in soil samples collected measured up to 2500 pCi/g. Sr-90 is probably present in this location, but was not specifically measured and analyzed. This area will require further inspection to determine the extent and depth of radioactive contamination. Some exploratory sampling within the fenceline and beneath the asphalt pavement will also be necessary. These levels of radioactivity are not a health hazard and do not require posting or access restrictions.

Additionally, slight radioactive contamination was detected on several miscellaneous components and facility systems at T064. Levels detected do not warrant decontamination. The top of light fixtures in room 110 are slightly contaminated with alpha activity (450 dpm/100 cm^2 max). A floor mop was contaminated with beta activity (10,000 dpm/100 cm^2 max). A Carey scale was also contaminated, showing beta activity at 10,000 dpm/100 cm^2, maximum. A Voland balance had slight removable alpha activity with an average of 37 dpm/100 cm^2 and maximum of 114 dpm/100 cm^2. A fume hood is known to be contaminated and was not surveyed. Both filter plenums show slight total beta activity in spots (primarily on pre-filters) with a maximum of 4500 dpm/100 cm^2. Removable contamination inside the filter plenums is slight (60 βdpm/100 cm^2 max) and limited to corners and cracks. These items are not hazardous and are contaminated at maximum levels less than acceptance limits. They should be disposed of as radioactive waste.

Radiation Measurements Facility, T029

Sealed radium sources were used at Building T029 (the Radiation Measurements Facility) from 1959 through 1964. Cs-137 sources replaced the radium sources in 1964, and were used through termination of facility operation in 1974. No residual radioactive contamination exists on the floor or surrounding area. The storage well for the primary calibrator,

which used a 12-in. diameter pipe extending 10 ft below floor elevation, is contaminated. In 1964, a Ra-226 source fell to the bottom of the well, cracked, and released contamination. The source thimble was raised from the well bottom and measured 2800 α-dpm/100 cm^2. The extent of contamination inside the well needs determination. Remedial action will be required, and this will involve a fairly major operation to remove the concrete and associated hardware from the 10-ft deep well.

Buildings T030 and T641

The radiological survey of Buildings T030 and T641 (formerly the Particle Accelerator Facility, and Shipping and Receiving, respectively), showed no detectable activity above naturally occurring background. This survey included beta surface activity in suspect locations and tritium analysis in 10 soil samples collected to the west of T030.

Old ESG Salvage Yard, Rocketdyne Barrel Storage Yard, New Salvage Yard

The radiological survey of the Old ESG Salvage Yard, Rocketdyne Barrel Storage Yard, and the New Salvage Yard (T583) showed a small location contaminated with mixed fission products. The southwest corner of Rocketdyne's Barrel Storage Yard is a low settling spot for surface water and was muddy at the time of this survey (in the Spring). Cs-137 was found in concentrations slightly exceeding 100 pCi/g. This area is no more than 400 sq ft, with contamination extending to a depth thought, but not confirmed, to be less than 6 in. Further investigation and some minor remedial action are required in this small area. Soil samples were collected in drainage culverts leading from the old SRE pond through these inspected areas to check for radioactivity. No radioactivity above naturally occurring background was found. No further investigation is required in any of these areas except for the one isolated spot located in the Barrel Storage Yard.

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T513 Parking Lot, Old Radioactive Laundry, SRE Storage and Trash Dump, SRE-to-RMDF Field, KEWB-to-RMDF Field

The radiological survey of the T513 Parking Lot, Old Radioactive Laundry Area, SRE Storage and Trash Dump (Plot 333), SRE-to-RMDF Field, and the KEWB-to-RMDF Field showed no detectable activity above naturally occurring background. These locations were either natural terrain or paved areas. Residual radioactivity was not originally suspect; the survey was performed to determine whether some radioactive material had accidentally been dispersed or left behind. No further investigation is necessary in these locations.

Buildings T019 and T013, T262 Storage Yard, Northwest Area

The radiological survey in Buildings T019 and T013, the T626 Storage Yard, and an extensive natural-terrain area northwest of Buildings T059, T019, T013, and T012 showed no residual radioactivity. Building T019 was the only facility which handled radioactive or nuclear material. SNAP reactor zero-power testing was performed there. Further inspection is not required in these locations.

T056 Landfill, 23rd Street to T100 Storage Yard, T011 Field

Results of the radiological survey of the T056 Landfill, a storage yard between 23rd Street and Building T100, and a field across from Building T011 showed no residual radioactivity. Subsurface chemical contamination is suspect at the T056 Landfill because of material stored and disposed there. Subsurface sampling for radioactive contaminants in that landfill was beyond the scope and budget of this survey. Radioactive contaminants are not highly suspect below grade because of radiological controls which were imposed and complied with during its operation. This however, does not preclude the possibility that radioactive contamination is possible below grade. If extensive subsurface sampling is performed at the T056 Landfill for chemical analysis, surveys for radioactivity should be performed

concurrently. Otherwise, no further inspection is necessary in these locations.

Buildings T373, T374, T375

Results of the radiological survey performed in Buildings T373, T374, and T375, and surrounding areas showed that the areas are not contaminated with residual radioactivity. Building T373 was the only nuclear-related facility; SNAP reactor critical testing was performed there. An extensive survey for total and removable alpha/beta activity showed no statistically significant activity. Collection of smears in sinks, drains, showers, exhaust systems, and filter plenums also showed no detectable activity. No further inspection is necessary in these locations.

Buildings T049, T042, T027, T032, and T025

Results of a radiological inspection performed in Buildings T049, T042, T027, T032, and T025 showed that no residual radioactivity is present. These facilities were non-nuclear support buildings for SNAP, except for Building T049 which was a control center located within the fenceline of Building T005. An extensive survey for beta activity on miscellaneous facility components and systems resulted in finding a drip pan in Building T032 which was contaminated with Co-60 at a level of 25,000 dpm/100 cm^2. Total Co-60 activity in the pan amounted to about 0.02 microcuries, a very small quantity. The pan was removed from T032 and disposed of as radioactive waste. No further inspection is necessary in these locations.

Building T009

Results of the radiological survey performed in the west (OMR) side of Building T009 showed that measurable radioactivity is present in specific locations at levels well below acceptance limits. No further inspection or remedial action is required in those locations. The SGR side of T009 is used for In-service Inspection work, and is controlled as being

radioactively contaminated in certain areas, and therefore was not surveyed. A thorough sampling and analysis of crud, grease, and sludge collected from drain traps, showers, sinks, and machining tools showed no detectable activity. The SGR R/A liquid holdup tank, as expected, is internally contaminated with Th-232, U-238, Cs-137, and perhaps U-235 and Sr-90. The activity concentrations are small, but the tank should be removed and dispositioned as low level radioactive waste. Drain lines leading to that tank should also be checked for radioactivity when the tank is removed. All other areas surveyed were found acceptably clean.

PROJECT REPORTS

"Radiological Survey of Building T005," GEN-ZR-0003, J. A. Chapman, Rockwell International, February 1, 1988.

"Radiological Survey of the Sodium Disposal Facility - Building T886," GEN-ZR-0004, J. A. Chapman, Rockwell International, June 3, 1988.

"Radiological Survey of the Source and Special Nuclear Material Storage Vault - Building T064", GEN-ZR-0005, J. A. Chapman, Rocketdyne/Rockwell International, August, 1988.

"Radiological Survey of the Old Calibration Facility - Building T029", GEN-ZR-0006, J. A. Chapman, Rocketdyne/Rockwell International, August, 1988.

"Radiological Survey of Shipping/Receiving and Old Accelerator Area - Building T641 and T030", GEN-ZR-0007, J. A. Chapman, Rocketdyne/Rockwell International, August, 1988.

"Radiological Survey of the Old ESG Salvage Yard, Rocketdyne Barrel Storage Yard, and New Salvage Yard (T583)", GEN-ZR-0008, J. A. Chapman, Rocketdyne/Rockwell International, August, 1988.

"Radiological Survey of the T513 Parking Lot; Old R/A Laundry Area; Plot 333; and Areas Between the SRE-to-RMDF, and KEWB-to-RMDF", GEN-ZR-0009, J. A. Chapman, Rocketdyne/Rockwell International, September, 1988.

"Radiological Survey of Building T019 and T013; An Area Northwest of T059, T019, T013, and T012; and A Storage yard West of Buildings T626 and T038", GEN-ZR-0010, J. A. Chapman, Rocketdyne/Rockwell International, September, 1988.

"Radiological Survey of the T056 Landfill; Area from 23rd Street to Building T100; and an Area Across from Building T011", GEN-ZR-0011, J. A. Chapman, Rocketdyne/Rockwell International, September 1988.

"Radiological Survey of Building T373 and T375", GEN-ZR-0012, J. A. Chapman, Rocketdyne/Rockwell International, September, 1988.

"Radiological Survey of Buildings T049, T042, T027, T032, and T025", GEN-ZR-0013, J. A. Chapman, Rocketdyne/Rockwell International, September, 1988.

"Radiological Survey of Building T009", GEN-ZR-0014, J. A. Chapman, Rocketdyne/Rockwell International, October 6, 1988.

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2. "Draft American National Standard Control of Radioactive Surface Contamination on Materials, Equipment, and Facilities to be Released for Uncontrolled Use," ANSI N13.12, August 1978, American National Standards Institute, Inc.

3. "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites," U.S. DOE, March 5, 1985.

4. "Termination of Operating Licenses for Nuclear Reactors", Regulatory Guide 1.86, U.S. Atomic Energy Commission, 1974.

5. "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," Annex B, USNRC License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International, last revision June 5, 1984.

6. "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations", Federal Register Vol. 46, No. 205, October 31, 1981.